

# **Automounting and Resources Sharing with Linux, SunOS and OpenBSD**

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## Abstract

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When a computer network is composed by hundred of computers it is important to keep most of the computers sharing a common set of resources to avoid moving from one computer from another searching for programs needed. In Unix-based systems using the Yellow Pages and automounting tools like the Amd Automount Daemon and Autofs can do this; with Yellow Pages Unix computers can share resources, like user passwords, and with automount all the users sharing the user passwords can see their same directories in any Unix computer. An OpenBSD computer was configured as a YP Master Server and NFS server. One Linux computer was set as a YP Client binding to this computer and another one was set as a YP Slave Server of the OpenBSD computer. The Linux computer that was set as a YP Slave was configured to automount using autofs from a Sun computer and using amd from the OpenBSD computer. By doing this many common resources were shared between OpenBSD, Linux and SunOS computers.

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## **Introduction**

Computer Networks are sometimes composed of hundreds of computers. In a national laboratory, like the Lawrence Berkeley National Laboratory, this is the case, and there will be scientists using different computer constantly. When this happens, it is important to keep all the computers sharing a common set of resources, so the scientist do not need to move from one computer from another searching for one that has the program that is needed. To do this, two of the things that can be done are use the Network Information Service (NIS), also known as Yellow Pages (YP), and use automounting.

NIS/YP is an RPC-based client/server system that allows a group of Unix-based computers within an NIS domain to share a common set of resources, like user accounts, password and group definitions. There are three types of hosts: YP Master Server, YP Slave Server and YP Client (Figure 1). The YP Master Server has all the databases of the users, groups and other resources shared within that domain stored locally; those databases are called NIS maps. A YP Slave Server has copies of all the NIS maps that the master server has stored locally too, it checks constantly too see if those maps have been updated, and downloads them. YP Clients establish bindings to a particular YP Server (slave or master), and read the NIS maps without downloading them.

Automounting is used to mount devices, shares, and partitions when needed, and unmount them when they are not required. The packages used can handle NIS maps; this can be used to automount the users home directories, and different shares from the NIS Server when they are needed only, instead of mounting NFS shares remotely. If all the computers within an NIS domain automount the home directories from a server, the users

will be able to look at their files in any computer that they use. Two of the packages used for automounting are autofs, and am-utils.

## Materials and Methods

Five computers were used, a Sparc20 running OpenBSD 2.7 named **esg31**, a Sparc5 running SunOS 5.7 named **bl7-46.als**, a SparcUltra30 running SunOS 5.5.1 named **bl7-17.als**, a dual Pentium III running Mandrake Linux 7.0 named **piggy** and a 586 running RedHat Linux 6.0 named **esglinux**.

Some NIS/YP packages were installed on **piggy** and **esglinux**; ypserv-1.3.9-1 was installed on piggy, and yp-tools-2.3-5 and ypbind-3.3-24 were installed on both **piggy** and **esglinux**. Two automounting packages were installed in **piggy**: am-utils-6.0.3 (that provides the Automounting Daemon (amd)) and autofs-3.1.4.

Piggy was configured as a YP Client binding to the **esgsuns** NIS domain and the **bl7-46.als** ypserver. The NIS domain was set to **esgsuns** with 'domainname esgsuns', the /etc/yp.conf was edited and the ypbind daemon was started (Figure 2). The /etc/dfs/dfstab file was edited in the **bl7-46.als** machine, so that **piggy** could automount NFS volumes from this machine locally (Figure 3). Afterwards, autofs was configured in **piggy**, and two autofs map files were edited in the /etc folder, auto.master and auto.home (Figure 4). This auto.home map file, read the auto\_home and auto.home map files from the **bl7-46.als** computer (Figure 5) and appended them to the local auto.home file. **Bl7-17.als** was used to verify if the syntax of the autofs map

files were correct, since it was also a YP Client binding to the same domain and it was running autofs. Amd, the Automount Daemon, was also configured in **piggy** to be able to automount from **bl7-46.als** (Figure 6), the `/etc/amd.conf` was edited (Figure 7) and several amd map files were created, `/etc/amd.home` (Figure 9) to automount in `/home`, and `/etc/amd.net` (Figure 9) to be able to automount in `/net`.

OpenBSD was installed in **esg31** to be able to set the computer as a YP Master Server. The NIS domainname was set with the command `'domainname piggybsd ; domainname > /etc/defaultdomain'`. Then `ypinit -m` was run to set it as a YP Master Server (Figure 10). To make the yp server start properly some lines had to be added to the `/etc/rc.conf` file (Figure 11). The computer was rebooted to make the changes available. After the server was up and running, **piggy** was configured as a YP Slave Server manually (Figure 12) and **esglinux** as a YP Client.

**Esg31** was set as an NFS (Network File System) server so that the 2 Linux boxes could automount the home directories locally. In order to do this the value of the NFS\_SERVER switch in the `/etc/rc.conf` file was changed to YES and the following line was added to the `/etc/exports` file: `/u0/home -alldirs -network 131.243.96 -mask 255.255.252.0`. Then, the amd automounter was configured on the three machines (**esg31**, **piggy** and **esglinux**) to automount the user directories in **esg31** (`/u0/home/[username]`) in the `/home/[username]` (Figure 13).

## Results

**Esg31** was turned into a YP Master Server and NFS server and **esglinux** ran as a YP Client with no problems. However, when trying to set the **piggy** into a YP Slave Server with the `'ypinit -s esg31'` it gave an error that said “Can't enumerate maps from esg31. Please check that it is running.” All the configuration files were checked to see if there was something configured wrong on **piggy** but apparently everything was configured correctly. Since `ypinit -s` did not work, the map files were transferred to the `/var/yp/piggybsd` directory manually to be able to set it as a YP Slave Server.

Am-utils and autofs mounted successfully in both **esg31** and **piggy**. Even though when mounting from **bl7-46.als** all the local accounts in **piggy**, that were stored in `/home`, had to be moved to another folder to be able to automount successfully. There was no way of changing the home directory for the users in the NIS passwd map files, so when the users logged on the YP Client, they looked for their home directory in `/home/[username]`, so the `/home` directory had to be used as the mounting point for the home directories in the server.

## Discussion and Conclusion

The Yellow Pages and automounting services are very useful between different Unix-based operating systems. With automounting you can integrate Linux, SunOS, BSD and other Unix-based systems and make all the computers have a common set of resources,

excluding the binary files and any other type of files that cannot run in any computer architecture. If this was to be wanted, an amd map file can be configured to check the computer architecture, and depending on which it was it could mount a different set of volumes. With the Yellow Pages, all the users could be able to log into a Unix-based computer within an NIS domain and use their same username and password in all of them, so the users do not have to memorize a different username and password for each Unix computer they log into.

Usually many computers connected to an NIS/YP Server. It is recommended to set at least one YP Server per subnet unless you are only using Solaris 2. Because Solaris 2 YP Clients can cross subnets to find the YP Server, while other Unix systems may not. Also if anything happens and the Master Server goes down then all the YP Clients would be able to function because they wont be able to create a binding another server. Therefore, users still would be able to log in their computers. So when the master, or the slave server that a client is binding to goes down, the ypbind daemon will look for the next server on the list, it will create a binding to it, and users will be able to login their computers.

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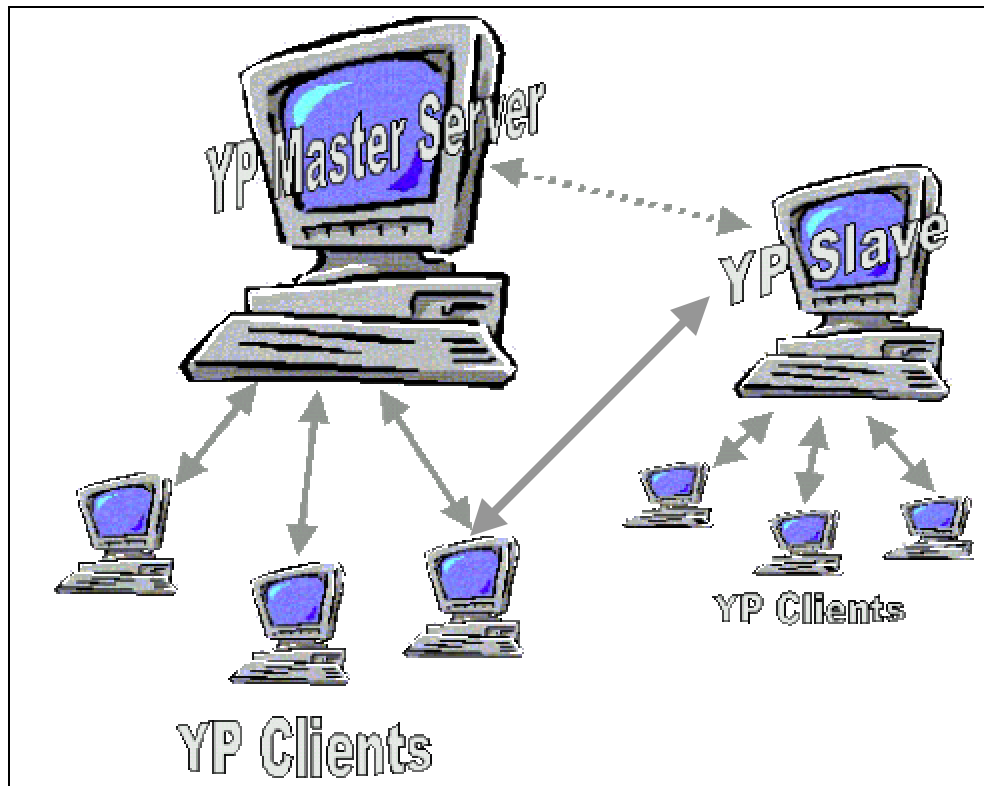
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## Figures



**Figure 1.** The YP clients establish bindings to the YP slave and master servers; the YP slave copies the NIS maps from the YP master server.

```
# /etc/yp.conf - ypbind configuration file
# Valid entries are
#
#domain NISDOMAIN server HOSTNAME
#    Use server HOSTNAME for the domain NISDOMAIN.
#
#domain NISDOMAIN broadcast
#    Use broadcast on the local net for domain NISDOMAIN
#
#ypserver HOSTNAME
#    Use server HOSTNAME for the local domain. The
#    IP-address of server must be listed in /etc/hosts.
#
domain esgsuns server bl7-46.als.lbl.gov
ypserver bl7-46.als
```

**Figure 2.** The ypbind configuration file (/etc/yp.conf) needed by YP clients in Linux.

```
# /etc/dfs/dfstab (bl7-46.als.lbl.gov)

/export/home/u0
#
share -F nfs -o rw=bl7-39.als:\
ophelia.lbl.gov:\
esgip.lbl.gov:\
stout.als.lbl.gov:\
pilsner.als.lbl.gov:\
bl93-102.als.lbl.gov:\
bl531.als.lbl.gov:\
twlab.lbl.gov:\
piggy.lbl.gov\      # < ---- This line was inserted
```

**Figure 3.** This shows the part `/etc/dfs/dfstab` file in a Sun computer. This file contains commands for sharing resources over the network. To be able to mount remotely in `piggy.lbl.gov` its address had to be inserted in this file.

```
# /etc/auto.master (piggy.lbl.gov)
# Master map for automounter
#
+auto_master      # Appends the contents of the auto_master file in the
                  # yp master (bl7-46.als) to /etc/auto.master
# mount point    map file      mount options
/home            /etc/auto.home -nobrowse
/misc            /etc/auto.misc

# /etc/auto.home (piggy.lbl.gov)
#
+auto_home        # Appends the contents of auto_home and auto.home from
+auto.home        # bl7-46.als to this one
```

**Figure 4.** The `/etc/auto.master` file is read by the `autofs` daemon when it is started, it lets it know where to automount which map files and the mounting options. The `auto.home` map will be used to automount in `/home` is the NFS shares listed in *Figure 5* with the command `automount mount-point map-type,[format] map [map-options]`, i.e. `automount /home file /etc/auto.home -nobrowse`.

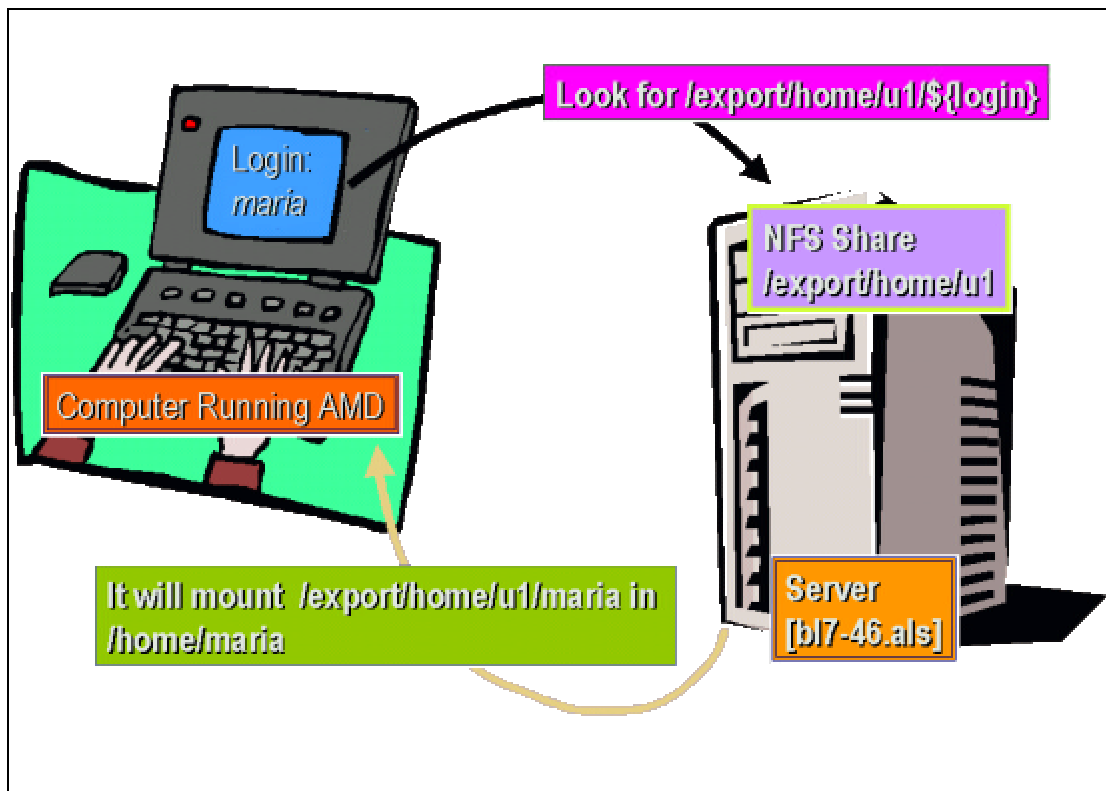
```

# auto.home (bl7-46.als)
# Home directory map for automounter
#
+auto_home
bl7user      bl7-46.als:/export/home/u0/bl7user
bl7oper      bl7-46.als:/export/home/u0/bl7oper
bl7data      bl7-46.als:/export/home/u0/bl7data
bl7data.stxmdata bl7-46.als:/export/home/u3
bl7guest     bl7-46.als:/export/home/u1/bl7guest
bl7work      bl7-46.als:/export/home/u1/bl7work
stxmdata     bl7-46.als:/export/home/u1/stxmdata
scratch      bl7-46.als:/export/home/u0/scratch
standard     bl7-46.als:/export/home/u1/standard

# auto_home (bl7-46.als)
# Home directory map for automounter
+auto_home
#
bl7dev       bl7-46.als:/export/home/u2/bl7dev
spemdev      bl7-46.als:/export/home/u2/spemdev
oldhomes     bl7-46.als.lbl.gov:/export/home/u4/u1.old
maria        bl7-46.als:/export/home/u1/maria
maria2       bl7-46.als:/export/home/u1/maria2

```

**Figure 5.** This is segments of the `auto_home` and `auto.home` map files in the yp master `bl7-46.als`.



**Figure 6.** This is an example of how the amd works.

```

#
# amd default config file
#
# check amd.conf(5) man page for details about options in this file
#
# GLOBAL OPTIONS SECTION
[ global ]
nis_domain          = esgsuns
normalize_hostnames = no
print_pid =         yes
pid_file =           /var/run/amd.pid
restart_mounts =     yes
auto_dir =           /.automount
#log_file =          /var/log/amd
log_file =           syslog
log_options =        all
#debug_options =     all
plock =              no
selectors_on_default = yes
print_version =      no
# set map_type to "nis" for NIS maps, or comment it out to search for all
# types
map_type =           file
search_path =        /etc
browsable_dirs =     yes
show_statfs_entries = no
fully_qualified_hosts = no
cache_duration =     300

# DEFINE AN AMD MOUNT POINT
[ /net ]
map_name =            amd.net
map_type =            file

[ /home ]
map_name =            amd.home
map_type =            file|nis

```

**Figure 7.** This is the amd configuration file (/etc/amd.conf) for a Linux computer.

```

# amd.net map file
/defaults fs:=${autodir}/${rhost}/root/${rfs}; \
          opts=nosuid,nodev,rsiz=8192,wsiz=8192

*          rhost:=${key};type:=host;rfs:=/

```

**Figure 8.** It automounts the exported nfs folder from any remote host specified in the /etc/hosts file in the amd default directory. If \${autodir} equals /.automount and the remote host (\${rhost}) equals bl7-46.als; then if the command 'cd bl7-46.als' is executed in the /net folder, the export folder from that computer will be automounted in /.automounter/bl7-46.als/root/.

```
# amd.home
/defaults opts:=nodev,nosuid,nobrowse
*      -opts:=nosuid \
      rhost:=bl7-46.als;type:=nfs;rfs:=/export/home/ul;sublink:=${key}
```

**Figure 9.** The users home directories, located in `/export/home/ul/[loginname]`, will be automounted in `/home/[loginname]`. If the remote file system (rfs) was set to `/export/home/ul/${key}` the users would see `/home/export/home/ul/[loginname]` instead of `/home/[loginname]` in **piggy**, this is why the sublink option is used, this tells the automounter to mount a subfolder from the remote file system.

```
>ypinit -m
Server Type: MASTER Domain: piggybsd

Creating an YP server will require that you answer a few questions.
Questions will all be asked at the beginning of the procedure.

Do you want this procedure to quit on non-fatal errors? [y/n: n]  n

At this point, we have to construct a list of this domains YP servers.
esg31 is already known as master server.
Please continue to add any slave servers, one per line. When you are
done with the list, type a <control D>.
    master server      :  esg31
    next host to add:  piggy.lbl.gov
    next host to add:  ^D
The current list of NIS servers looks like this:

esg31
piggy.lbl.gov

Is this correct? [y/n: y]  y
Building /var/yp/piggybsd/ypservers...
Running /var/yp/piggybsd/Makefile...
updated passwd
updated group
updated hosts
updated ethers
updated networks
updated rpc
updated services
updated protocols
updated netid
updated netgroup
updated amd.home

/var/yp/piggybsd/piggybsd-aliases: 10 aliases, longest 10 bytes, 112
bytes total
updated aliases

esg31 has been setup as an YP master server without any errors.
```

**Figure 10.** `ypinit -m` was executed on **esg31** to set it as a yp master.

```
nis_server_enable=YES
nis_server_flags=""
nis_yppasswd_enable=YES
nis_yppasswd_flags=""
```

**Figure 11.** These lines were added to the `/etc/rc.conf` file in **esg31** so that the YP Server could start properly.

```
[root@piggy yp]# ./ypxfr -f -C -d piggybsd -h esg31-s piggybsd group.bygid
Trying ypxfrd ... success
[root@piggy yp]# ./ypxfr -f -C -d piggybsd -h esg31 -s piggybsd group.byname
Trying ypxfrd ... success
[root@piggy yp]# ./ypxfr -f -C -d piggybsd -h esg31 -s piggybsd hosts.byaddr
Trying ypxfrd ... success
[root@piggy yp]# ./ypxfr -f -C -d piggybsd -h esg31 -s piggybsd hosts.byname
Trying ypxfrd ... success
[root@piggy yp]# ./ypxfr -f -C -d piggybsd -h esg31 -s piggybsd mail.aliases
Trying ypxfrd ... success
[root@piggy yp]# ./ypxfr -f -C -d piggybsd -h esg31 -s piggybsd netgroup
Trying ypxfrd ... success
[root@piggy yp]# ./ypxfr -f -C -d piggybsd -h esg31 -s piggybsd netgroup.byhost
Trying ypxfrd ... success
[root@piggy yp]# ./ypxfr -f -C -d piggybsd -h esg31 -s piggybsd netid.byname
Trying ypxfrd ... success
[root@piggy yp]# ./ypxfr -f -C -d piggybsd -h esg31 -s piggybsd passwd.byuid
Trying ypxfrd ... success
[root@piggy yp]# ./ypxfr -f -C -d piggybsd -h esg31 -s piggybsd passwd.byname
Trying ypxfrd ... success
[root@piggy yp]# ./ypxfr -f -C -d piggybsd -h esg31 -s piggybsd protocols.bynumber
Trying ypxfrd ... success
[root@piggy yp]# ./ypxfr -f -C -d piggybsd -h esg31 -s piggybsd protocols.byname
Trying ypxfrd ... success
[root@piggy yp]# ./ypxfr -f -C -d piggybsd -h esg31 -s piggybsd rpc.byname
Trying ypxfrd ... success
[root@piggy yp]# ./ypxfr -f -C -d piggybsd -h esg31 -s piggybsd rpc.bynumber
Trying ypxfrd ... success
[root@piggy yp]# ./ypxfr -f -C -d piggybsd -h esg31 -s piggybsd services.byname
Trying ypxfrd ... success
[root@piggy yp]# ./ypxfr -f -C -d piggybsd -h esg31-s piggybsd ypservers
Trying ypxfrd ... success
```

**Figure 12.** These set of commands were executed on **piggy** to transfer all the NIS map files from **esg31** locally manually to set it as a YP Slave Server.



1. Create a master map, this will include mount points and the name and locations of the map files:

```
# /etc/amd/amd.master
# mount-point    map-file
/home            /etc/amd/amd.home
```

2. Create the other maps needed:

```
# /etc/amd/amd.home
/defaults opts:=nodev,nosuid
*      -opts:=nosuid \
      host==esg31;type:=link;fs:=/u0/home;sublink:=${key} \
      host!=esg31;type:=nfs;rhost:=esg31;rfs:=/u0/home;\
      sublink:=${key}
```

3. Edit the `/etc/rc.conf` file to start the amd daemon automatically:

```
amd_dir=/tmp/mnt                # AMD's mount directory
amd_master=/etc/amd/amd.master  # AMD 'master' map
amd=YES
```

4. Reboot the computer to make the changes take effect.

**Figure 13.** Steps to follow in order to set up the amd automounter daemon on an OpenBSD computer (**esg31**). The `amd.home` file checks if the host equals `esg31`, if its so it will just create a link from `/u0/home/[loginname]` to `/home/[loginname]` instead of mounting; otherwise it will automount the users home directory in `/home/[loginname]` in the host computer.